

Draft

Arkansas Spinal Cord Commission

Regenerative Medicine Glossary

August 1, 2010

draft

Introduction

The field of spinal cord regeneration research is fairly new. Much of the research surrounds the repair of the spinal cord and nerves to allow them to regrow. There are numerous studies going on around the world using a variety of methods. Many of these methods use stem cells. For the average lay person, it sometimes seems that the research articles are written in another language – the terminology is unfamiliar to most of us.

In 2010, the Arkansas Spinal Cord Commission established a Task Force to collect information and develop resources to help Arkansans with spinal cord disabilities and their families learn more about this research and treatment to assure that we are all good consumers when it comes to this exciting but complex topic.

This glossary is the first of a set of resources. It appeared the natural start, as knowing what terms mean can help us in reviewing articles, web information and treatment options.

We hope you will find it useful.

Arkansas Spinal Cord Commission
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Activity Based Therapy

Activity based therapy – Therapy involving the forced use of the lower extremity with either a bicycle or a treadmill using just passive range or with the addition of electrical stimulation to cause the leg muscles to move the legs.

Body weight support ambulation training (BWST) – Upright walking on a treadmill with the body weight supported by a suspending harness with a therapist or a machine guiding and setting the limbs. Can significantly improve walking capability in incomplete spinal cord injuries.

Central pattern generator – An area (not well localized) in the lumbosacral spinal cord that generates repetitive step-like patterns without input from the brain.

Functional electrical stimulation (FES) – Surface electrodes or implanted wires can stimulate the nerves of a muscle to move. Muscles, which still have nerve input (usually as evidenced by spasticity of the muscle), can be stimulated by electricity and a computerized system to move and power a bicycle or walk on a treadmill.

Locomotor training – Training of the lower extremities with forceful movement of the legs with either a treadmill or a bicycle. Body weight support ambulation training (BWST) with manual assistance of a therapist or with robotic help, is one type of locomotor training. One type of robotic system is the Lokomat.

Biological Terminology

Apoptosis – Programmed cell death, or cell suicide, which is part of the natural life cycle of a cell. Combines with powerful autoimmune reactions after spinal cord injury to kill undamaged cells around the site of injury.

Astrocyte – Cells that nourish and support central nervous system neurons.

Axon – Long tail of a neuron that transmits electrical impulses away from the cell body.

Blastocyst – Group of cells derived from fertilized egg, which go on to form an embryo and placenta comprising 70 to 100 cells.

Demyelination – removal of myelin from the axon as a result of injury or disease process. Limits neurotransmission, which affects function and sensation.

Microglia – Immune scavenger cells of the brain and spinal cord that are among the first responders that flock to the site of an injury to remove debris.

Myelin – Fatty substance, produced by cells in the central nervous system known as oligodendrocytes. Myelin forms a protective sleeve around axons that enables them to conduct electrical impulses more efficiently. Myelin loss from damage or disease may cause the nerves to function poorly or not at all.

Necrosis – Cell death resulting from irreversible damage. Necrosis is a messy process compared to apoptosis. The dying cell swells and virtually explodes, spewing its contents and sending many damaging messages to neighboring cells, which may then be damaged or die. The byproducts of necrosis are not easily removed by scavenger cells (macrophages) and scar tissue forms.

Neuron – Basic cellular unit of the nervous system. Neurons come in assorted shapes and sizes, and each type has a specific role. Chains of neurons transmit electrical impulses throughout the body.

Neurotransmission – The process of nerve impulses traveling along a neural pathway. Responsible for sensation and motor control as well as control of the autonomic nervous system.

Neuroregeneration – The repair of damaged nerve cells. The environment within the central nervous system (CNS) is toxic to neuroregeneration while the peripheral nervous system (PNS) is permissive and helpful to regeneration. This is true especially following trauma. This toxic environment in the CNS counteracts the repair of myelin and neurons. Growth factors are not expressed or re-expressed. Scars rapidly form, and the glia actually produce factors that inhibit remyelination and axon repair.

Olfactory ensheathing cell – Cells that support the sensory neurons lining the nasal cavity. When transplanted into the spinal cord, these cells may remyelinate damaged axons.

Oligodendrocyte – Cells that enwrap an axon with their flattened membranes to create an insulating layer of myelin.

Schwann cell – Cells in the peripheral nervous system that wrap around axons to create a protective layer of myelin, similar to oligodendrocytes in the central nervous system. They also may promote nerve regeneration following an injury.

Stem cell – A cell with the following properties: 1) capable of dividing and renewing themselves for long periods of time, 2) unspecialized in their function, 3) can give rise to specialized cell types.

- **Adult (multipotent) stem cell** – a stem cell possessing these properties: 1) the ability to self renew through several cell divisions while maintaining an undifferentiated state and 2) multipotency (see below). These cells do not have to be harvested from embryos. Typically, there is a very small number of stem cells in each adult tissue, and once removed from the body their capacity to divide is limited making generation of large quantities of adult stem cells difficult. In spite of this, scientists are excited about the fact that adult stem cells have been found in many more tissues than they once thought possible and are hopeful that these cells can one day be used for transplantation.
- **Embryonic (pluripotent) stem cells** – are most often derived from embryos that develop from eggs that have been fertilized *in vitro*—in an *in vitro* fertilization clinic—and then donated for research purposes with informed consent of the donors. They are *not* derived from eggs fertilized in a woman's body. The embryos from which human embryonic stem cells are derived are typically four or five days old and are a hollow microscopic ball of cells called the blastocyst.
- **Induced pluripotent stem cells (iPSCs)** – are adult cells that have been genetically reprogrammed to an embryonic stem cell-like state. Although these cells meet the defining criteria for pluripotent stem cells, it is not known if iPSCs and embryonic stem cells differ in clinically significant ways.

Stem cell potency – Specifies the differentiation potential or flexibility of a stem cell to evolve into different types of specialized tissues.

- **Multipotent** – cells that have the ability to develop into more than one cell type of the body.
- **Pluripotent** – cells that have the ability to give rise to all of the various types of the body.

Synapse – The connection between two neurons (or between a neuron and a non-neuronal cell such as muscle) that enables them to communicate. Synapses enable nerve impulses to travel through chains of neurons and for neurons to provide a stimulating or inhibiting signal to the next neuron in the chain.

Research Terminology

Adherence – The degree to which one is able to follow the course of treatment.

Clinical trial – Research with human participants conducted to collect safety and efficacy data, guide and direct potential clinical health interventions.

Data – Information that represents the attributes of a set of variables. In a clinical trial, this is framed by the effect a treatment has on the research participant.

Experiment – a process carried out using the scientific method to answer a question or investigate a problem.

- **Blind experiment** – an experiment where some of the persons involved (subjects or researchers) are prevented from knowing certain information about the experiment that might lead to observer bias, conscious deception, or a placebo effect that would invalidate results.
- **Double blind experiment** – an experiment where neither the subjects nor the researchers know who belongs to the control group and the experimental group. Performing an experiment in a double blind fashion is a way to lessen the influence of the prejudices (listed above) that might be involved in a blind experiment.

Functional improvement – A change in a biomechanical/physiological activity that results in a person's being able to do something that he or she previously was unable to do due to injury or a disease process affecting the spinal cord. It is objective, yet it may have a subjective component for the individual. It does not, necessarily correlate with an increase in functional activities.

Informed consent – The requirement that all persons who can be identified as participants in a research trial must be provided with all relevant information about their participation, including potential risks and benefits, all proposed activities and interventions, opportunity to ask questions and withdraw, and other options to participation.

Medical tourism – The practice of travelling across international borders to obtain healthcare. Services typically sought by travelers include elective procedures as well as complex specialized treatments often not available in the United States. Providers and consumers of the services use informal channels of communication-connection-contract to access the services, meaning less regulatory or legal oversight to assure quality and less formal recourse to results, reimbursement or redress, if needed. There are risks and ethical issues that make this method of accessing medical care controversial due to hazardous situations in some destinations where these services are provided and the concerns that healthcare providers often practice outside of their areas of expertise or hold different (i.e., lower) standards of care. Since consumers are frequently unable to

meet with the providers or see the facilities in advance of travelling for treatment, it is difficult to make informed decisions in choosing these treatments.

Observer bias – Phenomenon that occurs when a researcher's preconceived ideas unconsciously affects a participant in a clinical trial.

Participant (human subject) – A living individual about whom a research investigator obtains: 1) data through intervention or interaction with the individual, or 2) identifiable private information.

Placebo – A sham or inert treatment that has no clinical effect, used in a clinical trial to contrast against the active test treatment.

Placebo effect – A positive medical reaction to a placebo (or sham treatment). Though placebos are intended to be psychologically inert and are used as controls to test the effectiveness for research interventions, about 30% of all clinical participants experience a "placebo effect".

Reasonable expectation – The ability to actually weigh the likelihood of improvement given the present situation, the proposed treatment and anticipated results. As applied to spinal cord injury, this should take into account level of injury, date of entry, age, and functional goals. This generally requires counseling from a healthcare provider case manager.

Reproducibility – Ability of a test to be accurately reproduced, or replicated, by someone else working independently.

Research – A systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.

Therapeutic misconception – The belief of a research participant that the clinical intervention that the research is studying is intended to treat the participant's illness or medical condition when, in fact, the intent of the research is to collect information about the effects and effectiveness of the intervention.

References

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